MERIT SENSOR™

DATA SHEET

LP Series – Digital

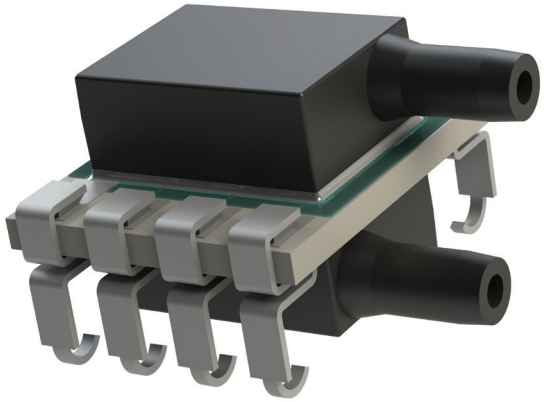
LP Series - Digital is a surface mountable pressure sensor package with a compensated digital output suitable for **ultra-low pressure sensing applications.**

COMPANY: Merit Sensor is a leader in piezoresistive pressure sensing and partners with clients to create high performing solutions for a variety of applications and industries.

SENTIUM: Merit Sensor products incorporate a proprietary Sentium® technology developed to provide superior stability.

TECHNOLOGY: Merit Sensor utilizes a piezoresistive Wheatstone bridge in a design that anodically bonds glass to a chemically etched silicon diaphragm. All products are RoHS compliant.

CAPABILITIES: Merit Sensor designs, engineers, fabricates, dices, assembles, tests, and sells die and packaged products from a state-of-the-art facility near Salt Lake City, Utah.



RoHS Compliant

FEATURES

Pressure Range	0.04 to 15 psi (2.5 mbar to 1 bar; 250 Pa to 100 kPa KPa; 1 in H_2O to 415 in H_2O)
Output	Digital I^2C
Type	Gage, Differential and Absolute
Media	Clean, Dry Air and Non-corrosive Gases
Packaging	Tape and Reel
Customization	Supply Voltage, Temperature Calibration Range, Output Range, Accuracy Specification, Update Rate, etc

BENEFITS

Performance	Enjoy best-in-class performance due to Merit's proprietary Sentium technology
Cost	Save money over time with high-performing die
Security	Feel confident doing business with an experienced company backed by a solid parent company (NASDAQ: MMSI)
Speed	Get to market quickly with creative and flexible solutions
Service	Experience prompt, personal and professional support

1420 Family Part Number Configurator

1420-XXXX-XX11-XX1

Pressure
P04 = 250 Pa
P07 = 500 Pa
P15 = .15psi
P30 = .30psi
1P0 = 1.0psi
15P = 15psi

Reference
D = Differential
G = Gage
A = Absolute

Clock Speed
1 = 1MHz

I²C Address
0 = 0x28
1 = 0x38
2 = 0x48
3 = 0x58
4 = 0x68
5 = 0x78
6 = Open*

Pin Type
1 = J-lead

Port
1 = Dual horizontal, facing same direction
2 = Single Horizontal

Calibrated Supply Voltage
1 = 5.0V
2 = 3.3V

Update Rate
1 = 25ms

Operation Mode
1 = Update mode constant

*Device will respond to any address.

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SPECIFICATIONS

Parameter	Minimum	Typical	Maximum	Units	Notes
Electrical					
Supply Voltage (Vs)	4.5	5	5.5	V	Depending on calibrated supply voltage
Supply Voltage (Vs)	3.0	3.3	3.6	V	Depending on calibrated supply voltage
Supply Current	1.2	2	3.5	mA	(1)
Operating Temperature	-40		85	°C	
Storage Temperature	-55		100	°C	
Performance					
Effective ADC Resolution		13		Bits	
Pressure Accuracy	-1.5		1.5	%FS	(2) (3)
Long-Term Stability	-0.5		0.5	%FS	
Startup Time		10.4	12	ms	
Digital Update Time	21	25	29	ms	
Proof Pressure	5X				(4)
Burst Pressure	10X				

Notes:
(1) @5V input voltage,
(2) Over 0°C to 60°C
(3) Applicable if Vs = ±5% of the calibrated Vs
(4) Full scale pressure

Transfer Function Formula

$$P_{psi} = (P_{max} - P_{min}) \cdot \left(\frac{P_{counts} - 0.1 \cdot Max}{0.8 \cdot Max} \right) + P_{min}$$

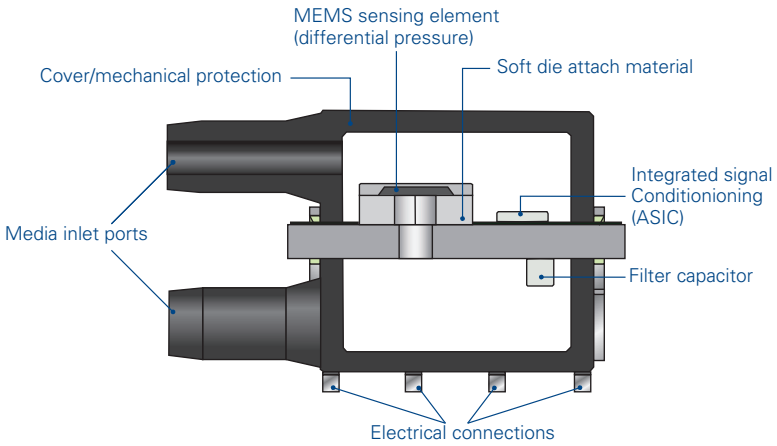
Where

P_{psi} = Measured Pressure in PSI
P_{counts} = Pressure Counts from Merit Sensor Part
P_{Min} = Minimum Pressure
P_{Max} = Maximum Pressure
Max = 16384 = 14 Bits

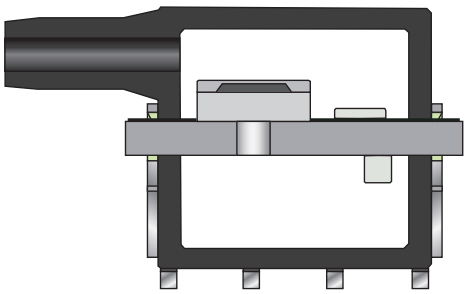
Media Compatibility

For Use With Non-corrosive Dry Gasses
Solder temperature: max 250 °C, 5 seconds max

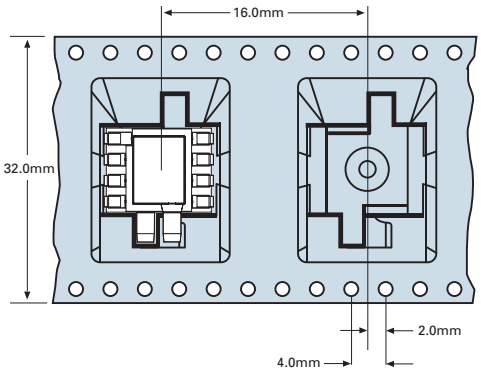
CROSS SECTION FOR DIFFERENTIAL AND GAGE



CROSS SECTION FOR ABSOLUTE

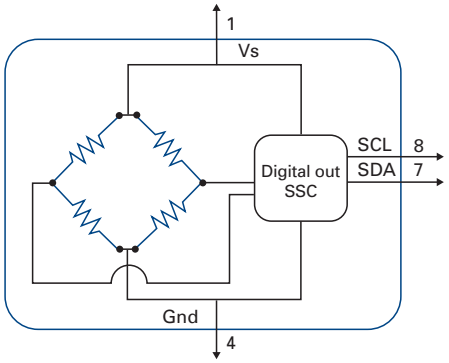


PACKAGING



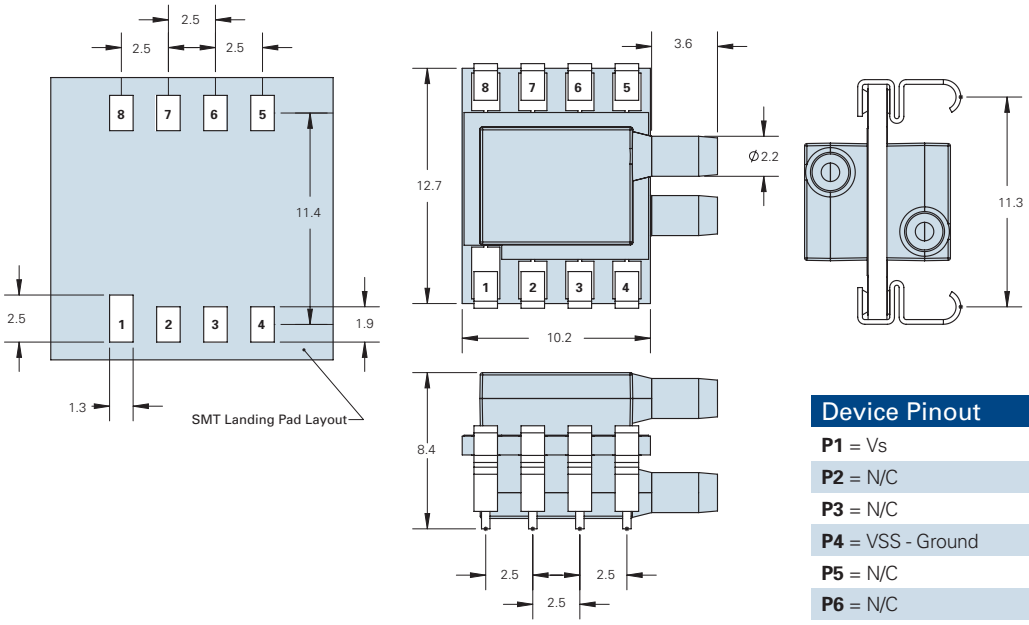
ELECTRICAL

Note: Power supply decoupling included



DIMENSIONS FOR STANDARD OPTIONS (in millimeters)

Dimensions for reference only. Engineering drawings (with tolerance) available upon order.



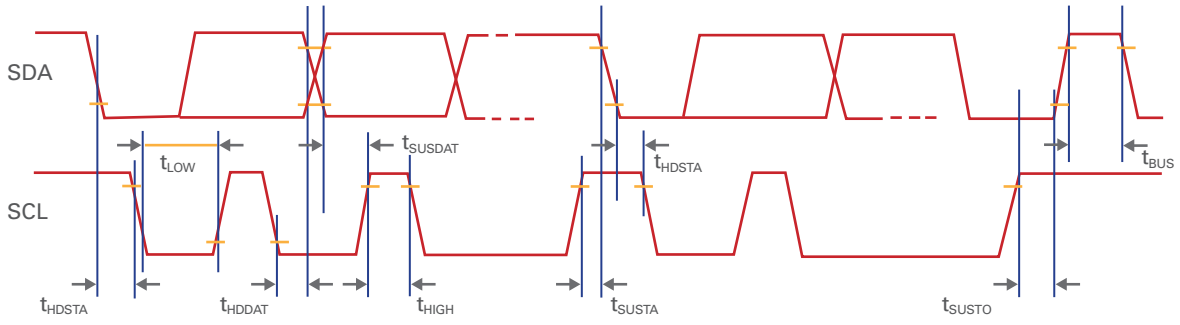
Device Pinout
P1 = Vs
P2 = N/C
P3 = N/C
P4 = VSS - Ground
P5 = N/C
P6 = N/C
P7 = SDA - I²C data
P8 = SCL - I²C clock

I²C PARAMETERS *

Parameter	Symbol	Min	Typ	Max	Units
SCL clock frequency	f_{SCL}	-		100	kHz
Start condition hold time relative to SCL edge	t_{HDSTA}	0.1			µs
Minimum SCL clock low width[1]	t_{LOW}	0.6			µs
Minimum SCL clock high width[1]	t_{HIGH}	0.6			µs
Start condition setup time relative to SCL edge	t_{SUSTA}	0.1			µs
Data hold time on SDA relative to SCL edge	t_{HDDAT}	0.0			µs
Data setup time on SDA relative to SCL edge	t_{SUDAT}	0.1			µs
Stop condition setup time on SCL	t_{SUSTO}	0.1			µs
Bus free time between stop condition and start condition	t_{BUS}	2			µs

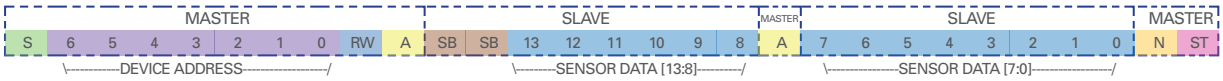
1Combined low and high widths must equal or exceed minimum SCLK period.

I²C TIMING DIAGRAM*



MERIT SENSOR 1420 I²C COMMUNICATION

Communications to the 1420 is read only. To read the pressure counts, the master performs a read request by asserting a start condition, sending the 7 bit address of the part (If the part has an open address, 7 bits of anything is acceptable), and sets the read/write bit. The master then waits for an acknowledgment. The acknowledgment is sent by the pressure sensor along with 2 bits of status and bits 13:8 of the pressure counts, the master acknowledges the first 8 bits, and the pressure sensor sends the remaining 8 bits of data. The Master then does not acknowledge and sends a stop condition signaling the end of the transaction.



S	Start Conditioning	#	Device Slave Address	#	Data Bit	Status Bits	
RW	Read/Write Bit	A	Acknowledge Bit	N	No Acknowledge Bit	0 0	Normal Operation, Good Packet
ST	Stop Condition	SB	Status Bits			0 1	Device in Command Mode
						1 0	Stale Data
						1 1	Diagnostic Condition Exsists

*Used by permission, IDT

TRANSFER FUNCTION EXAMPLES

Example 1: 0.15 PSI Gage

Part: 1420-P15G-xx11-111

P_{min} =0.0 *PSI*

P_{max} =0.15 *PSI*

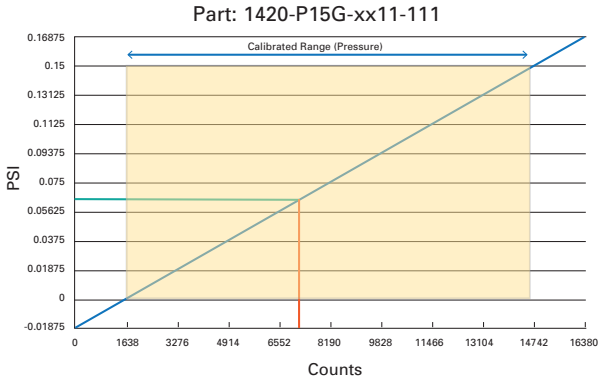
P_{counts} =7215

Max =16384

$$P_{psi} = (P_{max} - P_{min}) \cdot \left(\frac{P_{counts} - 0.1 \cdot Max}{0.8 \cdot Max} \right) + P_{min}$$

$$P_{Psi} = (0.15 - 0.0) \cdot \left(\frac{7215 - 0.1 \cdot 16384}{0.8 \cdot 16384} \right) + 0$$

P_{Psi} = .0638 *Psi*



Example 2: -.5 to .5 PSI Differential

Part: 1420-P50D-xx11-111

P_{min} = -0.5 *PSI*

P_{max} = 0.5 *PSI*

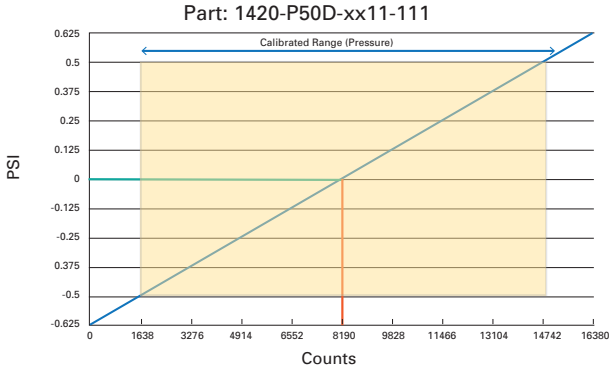
P_{counts} =8192

Max =16384

$$P_{psi} = (P_{max} - P_{min}) \cdot \left(\frac{P_{counts} - 0.1 \cdot Max}{0.8 \cdot Max} \right) + P_{min}$$

$$P_{Psi} = (0.5 - (-0.5)) \cdot \left(\frac{8192 - 0.1 \cdot 16384}{0.8 \cdot 16384} \right) + (-0.5)$$

P_{Psi} = 0.0 *Psi*



Mouser Electronics

Authorized Distributor

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Merit Sensor:

1420-P15D-1611-111 1420-P15G-1611-111 1420-1P0D-1611-111 1420-P30D-1611-111 1420-1P0G-1611-111 1420-P30G-1611-111 1420-1P0G-1011-111 1420-P15G-1011-111 1420-P30D-1011-111 1420-P30G-1011-111 1420-P15D-1011-111 1420-1P0D-1011-111 1420-P07D-1011-211 1420-P15D-1011-211 1420-P04D-1011-211 1420-P04G-1011-211 1420-P07G-1011-211 1420-1P0D-1011-211 1420-2P0D-1011-211